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TEACHER-MADE EXAMINATIONS--WHAT KIND OF THINKING DO THEY DEMAND.

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THIS STUDY WAS DESIGNED TO DETERMINE AND NOTE SIMILARITIES AND DIFFERENCES IN THE COGNITIVE OBJECTIVES OF EXAMINATIONS USED IN NINTH GRADE COURSES IN A JUNIOR HIGH SCHOOL. SEMESTER EXAMINATIONS FOR 1963-64 PREPARED BY INDIVIDUAL TEACHERS OR BY TEACHERS AS MEMBERS OF COMMITTEES WERE ANALYZED BY TEST ITEMS ACCORDING TO THE TAXONOMY OF EDUCATIONAL OBJECTIVES--COGNITIVE DOMAIN (A HEIRARCHY OF INCREASING COMPLEXITY FROM KNOWLEDGE, TO COMPREHENSION, TO APPLICATION, TO ANALYSIS, TO SYNTHESIS, TO EVALUATION). ITEM FREQUENCIES WERE TABULATED AND PERCENTAGES CALCULATED. COURSES COVERED WERE CIVICS, COLLEGE PREPARATORY (CP) WORLD HISTORY, CP ALGEBRA, GENERAL MATHEMATICS, CP BIOLOGY, GENERAL SCIENCE, BEGINNING AND ADVANCED FRENCH, ENGLISH, HOME ECONOMICS, AND BUSINESS TRAINING. THOUGH THE RANGE OF COGNITIVE OBJECTIVES WIDENED FOR CP STUDENTS, EMPHASIS IN ALL 3 PROGRAMS OF STUDY (CP, BUSINESS, AND PREVOCATIONAL) WAS HEAVIEST ON KNOWLEDGE OF SPECIFICS. IN ALL PROGRAMS, AT LEAST HALF OF THE QUESTIONS REQUIRED ONLY MEMORY. THERE WAS OVERALL LACK OF CONCERN FOR THE AREAS OF ANALYSIS, SYNTHESIS, AND EVALUATION. ONLY IN ENGLISH AND, FOR A LIMITED GROUP, IN WORLD HISTORY, DID STUDENTS HAVE THE INTELLECTUAL CHALLENGE OF THE HIGHER COGNITIVE PROCESSES. DISCREPANCIES AND RECOMMENDATIONS FOR FURTHER RESEARCH ARE DISCUSSED. THIS ARTICLE WAS REPRINTED FROM THE BULLETIN OF THE NATIONAL ASSOC. OF SECONDARY SCHOOL PRINCIPALS, VOL. 49, SEPT. 1965. (AF)

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Teacher-Made Examinations

What Kind of Thinking Do They Demand?

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EXAMINATIONS constructed by teachers are a prominent consideration in the overall evaluation of students. They persist in importance from school entry to graduate programs, and their influence is pervasive, particularly upon the manner in which students study but more importantly upon the ways they think and the values they place on intellectual activities.

Tests reflect the objectives held by the teacher devising the examinations. Optimally, objectives for the course, unit, or lesson are stated prior to teaching, thus providing direction for both teacher and students in pursuing commonly understood goals and a reasonable guide to the evaluation of the undertaking. Even when objectives remain unstated, however, tests reflect the real objectives held by the teacher who prepares the examination. Most teachers know that most successful students are "test wise" to some extent. As students review or study for tests, they tend to focus their efforts on the kinds of materials which they expect the questions to require. If, for example, they believe the mathematics test will concentrate on word problems, they probably review typical kinds of problems. If they think that demonstrating relationships among chronological events will be important in a social studies test, they will stress such relationships in their study.

Since tests relate directly to the objectives of a course, a unit, or a topic, an analysis of these tests should indicate the kinds of objectives thought to be most important by the teachers de-

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veloping them. Do test items require pupils to demonstrate that they have memorized facts? Or do tests require students to think beyond facts, to demonstrate that they can apply their knowledge in a viable situation? Do tests demand that students analyze, synthesize, or evaluate—all "higher" thinking processes? In addition, do tests in different courses, even in diffierent curricular programs of study, emphasize different thinking requirements? This study was designed to gain evidence on such questions and to demonstrate the usefulness of a powerful analytic system. Specifically, its purpose was to determine and note the similarities and differences in the cognitive objectives in examinations used in ninth grade courses in a junior high school.

Procedure

Semester examinations for all ninth grade courses during the 1963-64 school year were secured from a junior high school in Northeastern Ohio. These tests had been prepared by the teachers, as individuals or as members of committees.

Test items were analyzed according to the *Taxonomy of Educational Objectives: Cognitive Domain.*[1] This system has six major categories in a hierarchy of increasing complexity: 1.00) Knowledge; 2.00) Comprehension; 3.00) Application; 4.00) Analysis; 5.00) Synthesis; and 6.00) Evaluation. In addition, each of these classes is subdivided into several sections. Examples of the major subclasses used in the study and illustrative test items are presented below:

a) Knowledge of specifics (1.10)—"A list of furnishings and appliances contained in a home is a (an) ————————."

b) Knowledge—ways and means of dealing with specifics (1.20) "An atom is to an element as a molecule is to a: (a) colloid; (b) mixture; (c) compound; (d) solution."

c) Knowledge—universals and abstractions in a field (1.30)—"Vital to making a democracy work in a large nation is (1) civil liberties, (2) political parties, (3) rule by an elected assembly, (4) a cabinet system, (5) all of these things."

d) Comprehension—translation (2.10)—"If n + 3 is an odd integer, what is the next larger odd integer? (a) m + 3, (b) n + 4, (c) n + 5, (d) 2m + 1, (e) Zn + 3."

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[1] Benjamin Bloom (Editor) *Taxonomy of Educational Objectives: Cognitive Domain.* New York: David McKay and Co., 1956, p. 207.

e) Comprehension–interpretation (2.20)–"Read *Pygmalion*. Write a summary being sure to tell what the miracle was."

f) Analysis–Elements (4.10)–"Analyze the following sentence: Mother gave a dollar to the paper boy."

g) Analysis–Organizational Principles (4.30)–"Give two important characteristics of the writing of each of the following: Kipling, Twain, Lindsay, Coleridge."

h) Synthesis–Production of a unique communication (5.10)–"Why is 'Three's A Crowd' considered a romantic play?"

i) Evaluation–Judgment in terms of external criteria (6.20)–"What do you feel is the most important concept you have learned in our study of literature?"

Each item on each test was categorized into the highest appropriate class or subclass. Then, the item frequencies were tabulated and percentages were calculated.

To establish reliability on the classification process, a sampling of items from each test was reanalyzed after a three week period. No change in classification resulted. In addition, another sample of test items was analyzed by another scorer experienced in the use of the *Taxonomy*, and the interscorer agreement was .87.

Findings

Cognitive Emphases in Ninth Grade Course Examinations

Percentage of test items categorized according to the major classes and their most prominent subdivisions of the *Taxonomy* are presented in Table 1.

In the social studies area, the civics examination emphasized exclusively the knowledge of specific information. The world history examination stressed knowledge of specifics, but also required students to engage in other types of thinking, including synthesis. Since the world history course was taken by students in the College Preparatory (CP) program perhaps the teacher believed the students could engage in such intellectual operations, whereas the teacher of civics, taken by non-CP students, may have believed his students were not capable of thinking beyond the memory level.

In the mathematics courses, CP students taking algebra again were faced with the demands of using a wide range of mental processes. Students electing general mathematics, on the other hand, had more questions involving memory of specific facts and

TABLE 1. Percentage Distribution of Classified Exam Items in Different Level Classes in a Subject Field[1]

	Social Studies		Mathematics		Science		French				English					
									Home	Bus.	Pr. E		Av. E		Ad. E	
Knowledge	Civics	WH	G Math	Alg.	G. Sci.	Biol.	Fr. I	Adv. Fr.	Ec.	Tr.	A	B	A	B	A	B
1.10	100	62	58	34	27	98	21	21	70	95	0	26	21	48	10	22
1.20	0	7	0	0	0	2	0	0	30	0	0	0	15	22	0	22
1.30	0	5	0	18	9	0	0	0	0	0	0	0	0	0	0	0
Comprehension																
2.10	0	0	6	6	0	0	29	7	0	0	0	0	0	0	0	0
2.20	0	4	0	0	0	0	0	0	0	0	0	30	0	0	0	0
Application																
3.00	0	2	36	42	64	0	50	71	0	5	20	10	15	4	22	4
Analysis																
4.10	0	0	0	0	0	0	0	0	0	0	10	30	10	0	15	25
4.30	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Synthesis																
5.10	0	20	0	0	0	0	0	0	0	0	45	4	25	25	30	25
Evaluation																
6.20	0	0	0	0	0	0	0	0	0	0	25	0	10	0	25	0

[1] *Abbreviations of Subject Fields.*

WH = World History
G Math = General Mathematics
Alg = Algebra I
G. Sci. = General Science
Biol. = Biology
Fr I = French I
Adv Fr = Advanced French
Home Ec = Home Economics
Bus Tr = Business Training
Pr E = Practical English
Av E = Average English
Ad E = Advanced English

fewer requiring application than students taking algebra. In science, however, CP students taking biology were asked questions over knowledge only. General science students, most of whom were enrolled in non-CP programs, were required to respond primarily to tasks of application; only about 25 per cent of all their questions were classified in the knowledge category. The examinations in the two French courses were quite similar, although French I demanded more interpretation and less application than did Advanced French.

In the English classes, the differences between the two teachers and their goals was pronounced. Each teacher had sections of the three ability levels. Teacher A, in all her sections, stressed a wide range of thinking processes. Teacher B, however, quite consistently emphasized knowledge (of specifics and ways and means of dealing with specifics) at all levels and gave only slight attention, for the most part, to the other cognitive processes. Whereas Teacher A asked all her students to engage in evaluation, Teacher B asked none of her students to engage in this task, not even those in the advanced course. Both teachers asked their average classes to engage in less complex mental processes than their other groups.

Questions on the home economics examination were entirely in the knowledge classification, 70 per cent calling for knowledge of specific facts. In business training, 95 per cent of the test questions required only knowledge of specific facts. The proportion of test items in both these courses calling for knowledge of specific facts seems unusually high, particularly in light of the fact that these courses purport to be "practical."

Cognitive Emphases in Ninth Grade Programs of Study

Findings previously presented indicate that, in general, CP students were required to take examinations encompassing a wider range of cognitive objectives than their non-CP counterparts. This observation is sharpened, however, when the data are grouped according to the three programs of study. Percentages of examination questions categorized according to the major Bloom categories for College Preparatory students (CP) are presented in Table 2, for Business (Bus) students in Table 3, and for Prevocational (PreV) students in Table 4. Because of the differences in objectives evidenced by the two English

TABLE 2. Percentage of Examination Items in College Preparatory Program Courses Classified in Differing *Taxonomy* Categories

Objectives	Algebra, Advanced French, Biology, English		Algebra, Advanced French, World History, English	
	English Teacher A	English Teacher B	English Teacher A	English Teacher B
Knowledge				
1.10	41	44	32	35
1.20	1	6	2	7
1.30	4	4	6	8
Comprehension				
2.10	3	3	3	3
2.20	0	0	1	1
Application				
3.00	34	29	34	30
Analysis				
4.10	4	6	4	6
Synthesis				
5.10	8	6	12	13
Evaluation				
6.20	6	0	6	0

TABLE 3. Percentage of Examination Items in Business Program Courses Classified in Differing *Taxonomy* Categories

Objectives	General Business, General Science General Mathematics		General Business, General Science, Algebra	
	English Teacher A	English Teacher B	English Teacher A	English Teacher B
Knowledge				
1.10	50	57	44	51
1.20	4	6	4	6
1.30	2	2	7	7
Comprehension				
2.10	2	2	2	2
Application				
3.00	30	27	32	29
Analysis				
4.10	3	0	2	0
4.30	1	0	1	0
Synthesis				
5.10	6	6	6	6
Evaluation				
6.20	2	0	2	0

TABLE 4. Percentage of Examination Items in Prevocational Program Courses Classified in Differing *Taxonomy* Categories

Objectives	General Math, Home Ec., General Science		General Math, Home Ec., Civics	
	English Teacher A	English Teacher B	English Teacher A	English Teacher B
Knowledge				
1.10	39	45	57	64
1.20	8	8	8	8
1.30	2	2	0	0
Comprehension				
2.10	2	9	2	9
Application				
3.00	30	28	14	12
Analysis				
4.10	2	8	2	8
Synthesis				
5.10	11	1	11	1
Evaluation				
6.20	6	0	6	0

teachers, data in each program are further subdivided. Thus, these three tables represent the cognitive emphases in the typical course schedules in the three programs.

The "recommended" CP program included English, probably the accelerated course, advanced French, algebra, and either biology or world history. Students in the business course, primarily girls, took English (for the most part, the average sections), general business, general science, and either general mathematics or algebra. Prevocational students took either home economics or industrial arts, English (probably in "basic" English sections), general mathematics, and either general science or civics.

Examination of Tables 2-4 reveals that there was great similarity in the cognitive objectives within each of the three programs of study, regardless of choice of major elective course. Table 5 summarizes, according to program of study, the percentages of examination items in each of the major *Taxonomy* categories. The similarity of cognitive objectives within programs persists between programs when one examines Table 5. Overall, the ninth grade examinations show teachers' preoccupation with

TABLE 5. Range of Percentage of Examination Items in Courses in the Three Programs of Study Classified in the Major *Taxonomy* Categories

Objectives	Prevocational %	Business %	College Preparatory %
Knowledge	49–72	55–65	40–54
Comprehension	2–9	2	3–4
Application	12–30	27–30	29–34
Analysis	2–8	0–3	4–6
Synthesis	1–11	6	6–12
Evaluation	0–6	0–2	0–6

knowledge of specifics. In all programs, at least half of a students' questions required only memory. For PreV students who took English with Teacher B and civics, almost three-fourths of their examination items called only for knowledge. Emphasis on recall of specific information showed a slight decline along the prestige alignment of programs from PreV to CP. Questions emphasizing comprehension received very little attention in all courses in each of the programs of study. Items requiring application of knowledge constituted quite similar proportions in all three programs, although there was somewhat less attention to application, interestingly enough, in the PreV program. Had it not been for English Teacher A, most students would have had no opportunity to engage in examination tasks requiring analysis, synthesis, and evaluation.

Discussion

The emphasis on memory in the ninth grade examinations analyzed in this study is not particularly surprising. Indeed, that only about half the items, considering tests in all courses, emphasized knowledge alone is interesting in itself. Since its possession is prerequisite to employing it in higher mental operations, teachers must properly be concerned that students acquire knowledge. Nevertheless, to exclude attention to other cognitive areas, as was done in the civics and biology tests, seems excessive. Surely, learning and thinking in these courses can and should involve some attention to operations other than memory. Very interesting, in this regard, is the observation that English Teacher A employed no "knowledge-only" questions with her low ability students.

The overall lack of concern for the objectives in the areas of analysis, synthesis, and evaluation, while not unusual, is surely depressing. In a sense, these junior high school students were intellectually deprived, not having the opportunity, at least on examinations, to deal with much of the basic nature of the courses. Thus, these students, academically able and potential dropouts, were treated to a steady diet of bits-upon-pieces, specific-upon-specific. Only in English and, for a limited group in world history, did students have the intellectual challenge of the higher cognitive processes. Surely, all these courses could have given attention to analysis, synthesis, and evaluation, perhaps in varying degrees, but at least some attention. Only as all courses focus attention on all the intellectual skills and processes will schooling begin to achieve the general goal of fostering thinking. At present, if this junior high school is at all representative of others in the nation, and there is evidence that it is above-average, much concerted attention to this problem is mandatory.

The great similarity within and between the several programs of study in this junior high school reveals inconsistent and perhaps unknown emphases. Are the cognitive objectives in the three programs of study really as similar as they appear to be? If they are, should they be? The apparent similarities certainly indicate that acquisition and application of knowledge are the most important categories of intellectual operations in these junior high school examinations. Even so, the summary similarities conceal the rather striking differences between certain components of the programs, particularly within the social studies, science, and the English areas. Courses in these fields emphasize different cognitive objectives without apparent rationale. Why should civics and world history differ so markedly in their emphasis upon types of thinking? If the reason is that civics is for less-able students, then why does biology, offered to the academically talented students, emphasize memory almost as much as civics? In this junior high school, the civics course was deliberately designed for potential dropouts so that they might have the understandings and skills required for effective community participation. This study would indicate that the aims have little chance of succeeding until the cognitive emphases are re-examined. Is it because general science students are less able that they are required to apply knowledge more than the "better" students in

biology? Or might it be that the general science teacher is attempting to make the "meat" of the course more meaningful and more palatable. That the prevocational and business students, because of academic aptitude, cannot handle the higher mental operations is a misconception is clear from the objectives emphasized by English Teacher A. Her "practical English" students were faced with more questions (a total of 80 per cent) in the analysis, synthesis, and evaluation categories than were her "advanced" students who are confronted by 70 per cent of their questions in those areas. It might be argued that she was demanding more than her students could achieve, but hard evidence is unavailable on that point at present. One may conclude, at least, that this teacher was not maintaining her less-able students on a regimen of memorized specific facts, but was encouraging them to go beyond knowledge to using it and thinking with it in different ways.

Probably, each course offered should provide opportunities for students to develop all of the cognitive skills. The extent to which each curricular area emphasizes each of the cognitive objectives surely is not identical. Recognition that knowledge is fundamental to all other cognitive goals is certainly not justification for emphasizing its acquisition to the exclusion of thinking processes.

The teacher-made examinations analyzed in this study clearly emphasized the objective of knowledge acquisition and the mental process of memory. Perhaps the examination items do not adequately represent the scope of intellectual objectives implemented by the teachers as they work in their classrooms. On this hypothesis there can be only doubt at present. Studies should be designed to investigate the nature of teachers' discourse, particularly their substantive remarks, for the cognitive objectives emphasized. In addition, teachers may very well be unaware of the extent to which they emphasize certain types of intellectual objectives and ignore others. Analysis of their own examinations, alone or as members of curriculum study groups, might well lead to better test items and as well, implementation of the general concern for the development of thinking in American schools.

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